



Advanced Worker Protection System (AWPS)



Developer: Oceaneering Space Systems, Inc.
Contract Number: DE-AC21-93MC30178
Crosscutting Area: N/A

Deactivation & Decommissioning FOCUS AREA

Problem:

Much of the work involved in the decontamination and decommissioning of DOE sites will require difficult tasks to be completed by workers in protective suits and respirators. The suits that will be worn essentially encapsulate the wearer's body, preventing the heat generated by the worker's activity from leaving the suit. The average worker cannot tolerate exposure to the resulting hot, humid atmosphere for more than 45 minutes, after which the worker has to "cool-down" for approximately 1 hour. Including donning and doffing and decontamination time, this makes for a work day that is at best less than 50% efficient and frequently only 25% efficient. New protection equipment and systems are needed to improve performance.

Solution:

Successful development and demonstration of a self contained, extended service time, breathing and cooling system, the Advanced Worker Protection System (AWPS). The AWPS uses liquid air to provide the worker with breathing air and full-body cooling for 2 hours without need for forced rest or "cool-down" periods.

Benefits:

- ▶ Full worker protection, air supply, and cooling for over two hours in a single integrated system
- ▶ Improved worker efficiency, shorter and less frequent rest and "cool-down" periods



- ▶ Safer working environment due to less worker stress from protective equipment
- ▶ Easier donning, longer use cycle, and improved comfort during use

- ▶ Potential for significant improvement in management planning and reduction in cleanup costs

Technology:

The AWPS is a liquid air based self contained breathing and cooling system. The AWPS employs a patented system developed by Oceaneering Space Systems that provides the user with breathing air and full body cooling while using only liquid air.

The system has a duration of 2 hours and workers will not require a rest or "cool-down" period after each suited-up session. This should increase the efficiency of each worker by more than 100%. The end effect of this system will also decrease the size of the secondary waste stream, decrease the number of workers required for a given task, and decrease the amount of time it takes for each job. Most importantly, the AWPS will create a safer working environment.

The AWPS consists of the primary life support components mounted in a backpack configuration similar to a self-contained breathing apparatus (SCBA); a pressure-demand regulator, hose, and mask delivery



device; a full-body liquid cooling garment; and outer-garment options of either a splash suit or a totally encapsulating vapor protection suit. The backpack includes the vacuum jacketed vessel or dewar, which contains the cryogenic liquid air. The liquid air is fed through a heat exchanger which uses the water warmed by the wearer's body to vaporize the cryogen for breathing, while it cools the water to control body temperature. The air is regulated to the appropriate pressure and delivered to the face mask. The cooled water is delivered to the full-body cooling garment.

The amount of cooling can be controlled by the wearer. Also, as the wearer breathes harder during higher work rates, more cooling will automatically be provided. A recharge station is required to fill the dewar on the AWPS with the liquid air. The present design allows this recharge station to be retro-fitted to SCBA charging units in use today.

Contacts:

Oceaneering Space Systems (OSS), a division of Oceaneering International Inc., is the prime contractor for the AWPS. The AWPS is one of many life support and cryogenic technologies being developed by OSS, which is also developing robotic and special application tools for use in the

environmental industry. For information on this project, the contractor contact is:

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